Check List the journal of biodiversity data
NOTES ON GEOGRAPHIC DISTRIBUTION

New record of *Myotis ciliolabrum* (Merriam, 1886) (Mammalia, Chiroptera) from the State of Mexico, Mexico

Noé González-Ruiz[1], Estefanía Nava[1], José Ramírez-Pulido[1], Diego F. García-Mendoza[2], Arturo Salame-Méndez[1], Alondra Castro-Campillo[1]

1 *División de Ciencias Biológicas y de la Salud, Universidad Autónoma Metropolitana, Unidad Iztapalapa, Ciudad de México, México*
2 *Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional (CIIDIR) Durango, Instituto Politecnico Nacional, Durango, Durango, México*

Corresponding author: *Noé González-Ruiz (noegr@xanum.uam.mx)*

Abstract. *Myotis ciliolabrum* (Merriam, 1886) is an insectivorous bat of the family Vespertilionidae and has a wide distribution from British Columbia, Alberta, and Saskatchewan in Canada, most of the western and central United States of America to central Mexico. In this study, we report one of the southernmost records from State of Mexico, based on two females collected in 1980 and stored in the Mammals Collection of the Universidad Autonóma Metropolitana. These records increases the knowledge on the distribution of this rare bat in Mexico.

Key words. Bats, Chiroptera, geographic distribution, Vespertilionidae, Western Small-footed Myotis

González-Ruiz N, Nava E, Ramírez-Pulido J, García-Mendoza DF, Salame-Méndez A, Castro Campillo A (2024) New record of *Myotis ciliolabrum* (Merriam, 1886)(Mammalia, Chiroptera) from the State of Mexico, Mexico. Check List 20 (1): 227–232. https://doi.org/10.15560/20.1.227

INTRODUCTION

Myotis ciliolabrum (Merriam, 1886) is an insectivorous bat of the family Vespertilionidae and is endemic to North America (Hall 1981; Simmons 2005; Holloway and Barclay 2001; Ammerman et al. 2016). It is morphologically distinguished from other North American *Myotis* Kaup, 1829 species by its small size (length of forearm generally <34 mm), the length of the hind foot is small (<½ length of the tibia), the calcar is keeled, and the dark wings, ears, and face contrast strongly with the yellowish-brown dorsal region (Holloway and Barclay 2001; O'Shea et al. 2018). Beyond their insectivorous habit, little is known about the feeding habits, ecology, natural history, or geographic distribution limit (Holloway and Barclay 2001), especially in the southernmost part of its distribution in Mexico, where, until now, it was considered to be a rare species, with few localities recorded and few specimens available for study in scientific collections (Godínez Álvarez 2005).

This taxon has variously been accepted as either a separate species or a subspecies and of its sister species, *Myotis californicus* (Audubon & Bachman, 1842) and *Myotis leibii* (Audubon & Bachman, 1842), due to similar morphology and differing geography variation (Van Zyll de Jong 1984; Holloway and Barclay 2001; Ammerman et al. 2016). This bat also has nomenclatural problems that directly affect the recognized name of the species, but not the distribution of this species in Mexico (Verts and Carraway 1998; Holloway and Barclay 2001). Four scientific names have been used Western Small-footed Myotis, *M. ciliolabrum*, *M. leibii*, *M. melanorhinus*, and *M. subulatus* (Holloway and Barclay 2001), but based on the proposal by Van Zyll de Jong (1984), the name of the species has remained relatively stable as *M. ciliolabrum* with two subspecies, *M. ciliolabrum ciliolabrum* (Merriam, 1886) and *M. ciliolabrum melanorhinus* (Merriam, 1890), although several authors consider these subspecies as different species (Simmons 2005; Ramírez-Pulido et al. 2014).

In addition to nomenclatural and taxonomic problems, perhaps the main problem is the identification of *M. ciliolabrum* because it is easily confused with *M. californicus* (Holloway and Barclay 2001; O'Shea et al. 2018), as shown by the number of misidentifications in scientific collections (Watkins et al. 1972; López-Wilchis et al. 1994). Despite their slight genetic divergence (Rodriguez and Ammerman 2004; Stadelmann et al. 2007; Ammerman et al. 2016; Platt et al. 2018), these species can be distinguished by their echolocation (O'Farrell et al. 1999; Gannon et al. 2001), external characteristics (Constantine 1998; Gannon et al. 2001), and morphological measurements (Bogan 1974; Van Zyll de Jong 1985), including cranial measurements (Bogan 1974; Van Zyll de Jong 1985; Verts and Carraway 1998).

Myotis ciliolabrum is found in western North America, from British Columbia, Alberta, and Saskatche- wan in Canada, through most of the western and central United States of America, to central Mexico. In

OPEN ACCESS

Academic editor: Faisal Ali Anwarali Khan
Received: 26 June 2023
Accepted: 4 December 2023
Published: 21 February 2024

Copyright © The authors. This is an open-access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International – CC BY 4.0)

Mexico the species' distribution is limited to the Mexican Altiplano in the western Sierra Madre Oriental and eastern Sierra Madre Occidental, to the southern record in Zacatecas (Holloway and Barclay 2001; Rodriguez and Ammerman 2004; Simmons 2005). Although this distribution is frequently represented in the literature, there are additional records in southern Mexico, in the states of Tlaxcala (López-Wilchis et al. 1994), Puebla (Polaco et al. 1992), and Michoacán (Villalpando and Alvarez 2000), which have been overlooked in the literature. Here, we report one of the southernmost records of *M. ciliolabrum* (Figure 1), which adds to knowledge on the distribution of this uncommon species in Mexico.

METHODS

In a routine review of the Mammal Collection of the Universidad Autónoma Metropolitana, Unidad Iztapalapa (UAMI), we found two specimens of *Myotis ciliolabrum* erroneously identified as *M. californicus*. These are adults because the union of the metacarpals and phalanges are completely ossified (Van Zyll de Jong 1985).

For taxonomic identification, descriptions, and comparisons, we used several references, including Bogan (1974), Van Zyll de Jong (1985), Simpson (1993), Constantine (1998), Rodriguez and Ammerman (2004), and Álvarez-Castañeda et al. (2017). We obtained data on sex, collection date, weight, location, collector's name, and somatic measurements (including total length, head and body, hind legs, and length of the ear) from the tag of each specimen.

External and cranial measurements were taken with digital vernier calipers (Mitutoyo; with 0.01 mm precision) following Van Zyll de Jong (1985) and Constantine (1998): total length (TL), length of tail (LT), length of foot (LF), length of ear (LE), length of forearm (LFO), greatest length of skull (GLS), length of maxillary toothrow (LMT), condyle–premaxillary length (CPL), condylocanine length (CCL), length of P4–M3 series (LPM), cranial breadth (CRB), mastoid breadth (MAB), least interorbital breadth (LIB), rostral breadth at M1–M2 (ROB), rostral breadth across canines (ROC), cranial depth (CRB), and height of coronoid process (HCP).

RESULTS

***Myotis ciliolabrum melanorhinus* (Merriam, 1890)**
Figure 2

Myotis subulatus melanorhinus—Hall and Kelson 1959; Hall 1981.
Myotis leibii melanorhinus—Glass and Baker 1965.
Myotis ciliolabrum melanorhinus—Van Zyll de Jong 1984.
Myotis melanorhinus— Simmons 2005; we maintain the taxon as *M. c. melanorhinus*; see discussion by Ammerman et al. (2016) and O'Shea et al. (2018).

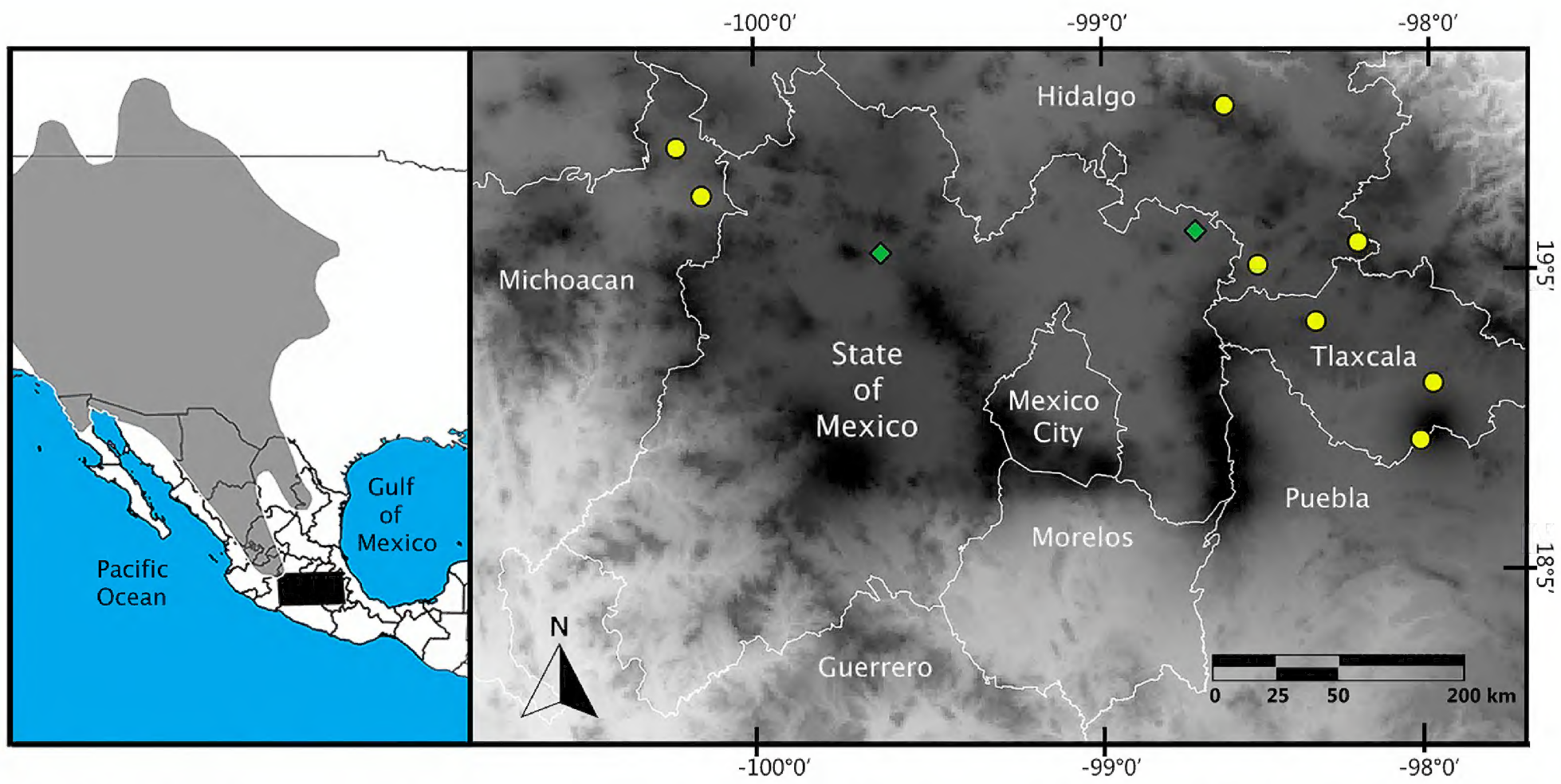

Figure 1. Distribution of *Myotis ciliolabrum*. **A.** Geographic distribution of *M. ciliolabrum* in North America (adapted from Holloway and Barclay 2001; Rodriguez and Ammerman 2004; Simmons 2005). **B.** Localities of specimens identified as *M. ciliolabrum* in the southernmost areas of its geographical distribution. Diamonds = new records from the State of Mexico; circles = localities of the neighboring states (see Polaco et al. 1992; López-Wilchis et al. 1994; Villalpando and Álvarez 2000).

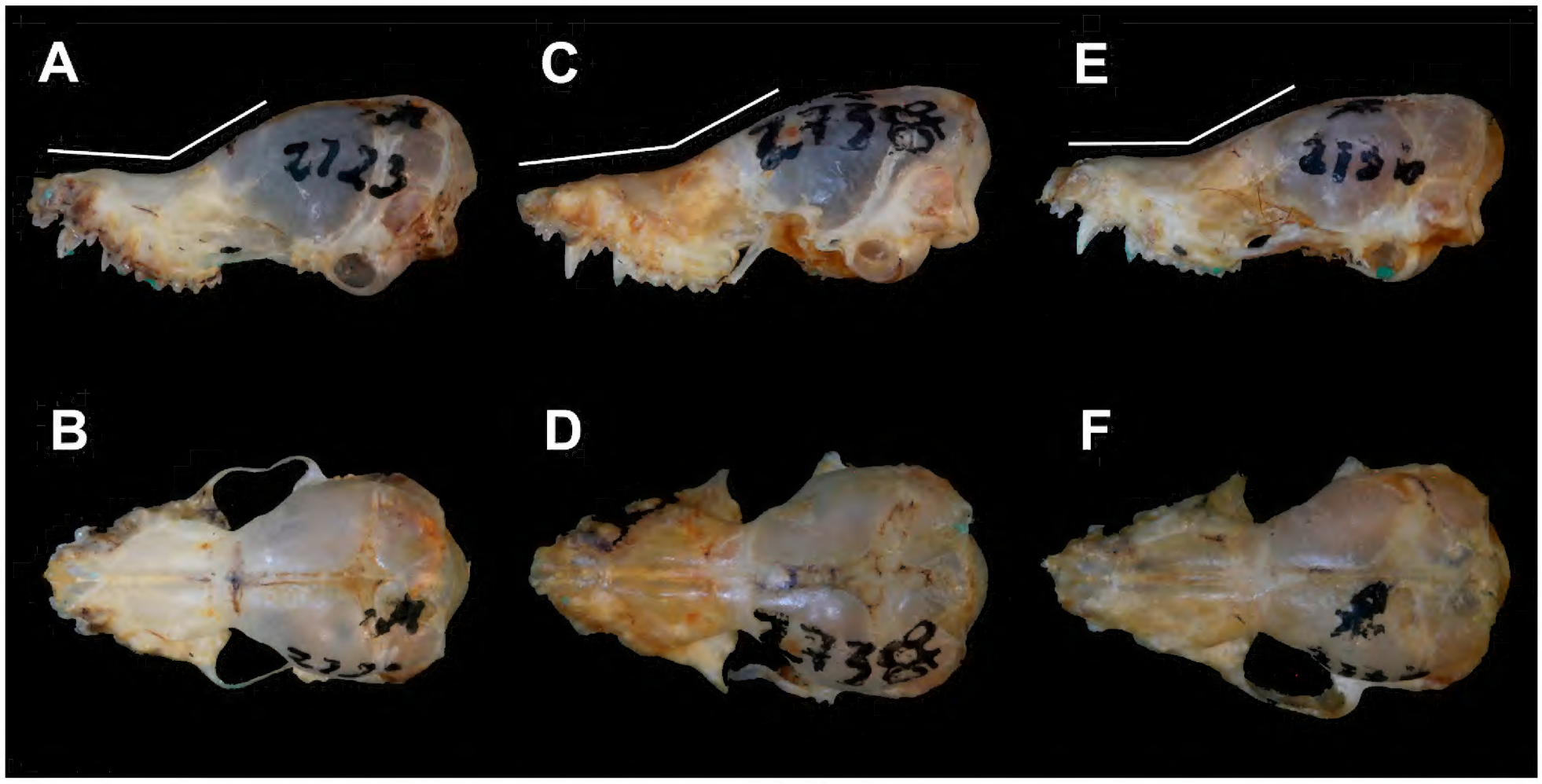

Figure 2. Comparisons of lateral and dorsal view of skull of *Myotis californicus* and *M. ciliolabrum* from the State of Mexico. **A, B.** *M. californicus* (2723 UAMI). **C, D.** *M. ciliolabrum* (2738 UAMI). **E, F.** *M ciliolabrum* (2736 UAMI). See Table 1 for measurements and morphometric differences.

New records. MEXICO – **Estado de México** • Ex-Hacienda Xala, 8 km N, 2 km E Otumba; 19°45′22″N, 098°39′03″W; 3085 m alt.; 11.III.1980; G. Ceballos G. leg. (collector number 248); 1 ♀; adult, skull, and skin (UAMI 2736) • 11 km W, 3 km N Tepotzotlán; 19°44′17″N, 099°40′03″W; 2380 m alt.; 29.V.1980; C. Galindo L. leg. (collector number 116); 1 ♀; adult, skull, and skin (UAMI 2738).

Identification. The examined specimens can be identified as belonging to the *leiibil/ciliolabrum/californicus* group by their small size, with length of forearm (normally <34 mm), by the small hind foot (<7 mm and <½

Table 1. Summary of morphological measurement of the *Myotis ciliolabrum* (2736 UAMI, 2738 UAMI) and three specimens of *M. californicus* from the State of Mexico. For abbreviations see Methods. All measurements are in millimeters.

	M. ciliolabrum		***M. californicus***
Measurement	**UAMI 2738**	**UAMI 2136**	**UAMI 14850, 2722, 2723**
TL	84	85	(77.0–84.0)
LT	39	37	(36.0–38.0)
LF	5	6	(6.0–7.0)
LE	14	13	(12.0–14.0)
LFO	33.6	35	(32.5–34.1)
GLS	13.7	14.1	(12.7–13.3)
LMT	5.2	5.2	(4.7–5.2)
CPL	13.4	13.3	(11.4–12.4)
CCL	12.3	12.6	(11.3–11.9)
LPM	3.6	3.9	(3.3–3.7)
CRB	7.3	7.1	(6.5–6.7)
MAB	7.3	7.2	(6.4–6.9)
LIB	3.4	3.6	(3.3–3.5)
ROB	5.7	5.4	(5.0–5.4)
ROC	3.7	3.5	(3.2–3.6)
CRB	5.8	5.8	(5.3–5.9)
HCP	3.1	3.2	(2.6–2.8)

length of the tibia), and a typically keeled calcar (Miller and Allen 1928; Van Zyll de Jong 1985; Verts and Carraway 1998; Alvarez-Castaneda et al. 2017). Cranially *M. ciliolabrum* differs from *M. californicus* by the angle formed between the rostrum and the frontal of the skull, which is visibly less pronounced (Figure 2). Externally, the ears, facial mask, and wing membranes of our specimens are black, which strongly contrasts with the pale dorsal hair and therefore different than in *M. californicus*, which is usually darker in color. In addition, when comparing some morphometric measurements (Table 1), those of *M. ciliolabrum* are larger, mainly in the greatest length of skull (GLS), condyle–premaxillary length (CPL), condylocanine length (CCL), cranial breadth (CRB), mastoid breadth (MAB), and height of coronoid process (HCP). The coloration, rostrum shape, and measurements of these specimens are clearly different, and they separate *M. ciliolabrum* from the sister and sympatric *M. californicus* (Bogan 1974; Van Zyll de Jong 1985; Constantine 1998).

DISCUSSION

The bats of the Mexican State of Mexico have been studied for many years (Herrera 1890; Villa-Ramírez 1953). This state is one of the most intensively sampled regions in Mexico (Ramírez-Pulido et al. 1995) and several lists of mammals have been published that include bats of this region (Ramírez-Pulido et al. 1995; Ramírez-Pulido et al. 1997; Chávez and Ceballos 1998; González-Ruiz et al. 2004; Chávez et al. 2009). The presence of *Myotis ciliolabrum* in the State of Mexico has been reported in the literature until now. Our records are the first from the State of Mexico, although this species has already been reported in the neighboring states of Michoacán, Hidalgo, Tlaxcala, and Puebla (Polaco et al. 1992; López-Wilchis et al. 1994; Villalpando and Álvarez 2000). Godínez Álvarez (2005) mapped the distribution of *M. ciliolabrum* further south in Michoacán and Guerrero. However, there are no confirmed records of this species in Guerrero (Lukens and Davis 1957; Almazán-Catalán et al. 2009), Morelos (Davis and Russell 1952, 1954; Álvarez-Castañeda 1996), or southern Michoacán, although there are confirmed records from northern Michoacán (Villalpando and Álvarez 2000; Wang et al. 2003; Núñez Garduño 2005; Monterrubio-Rico et al. 2014). Additionally, there is a lack of distributional records from other regions in southern Mexico (Ramírez-Pulido et al. 1986, 1990, 1994, 2000, 2017), and until now the distribution of *M. ciliolabrum* in southern Mexico has not been confirmed. Therefore, the present records represent the southernmost limit of the known range of *M. ciliolabrum*, and, together with the other records mentioned, confirms that this species has its southern limits in the foothills of the Transversal Neovolcanic Belt (TNB) and not Zacatecas, as has often been represented in the literature (Holloway and Barclay 2001; Rodriguez and Ammerman 2004; Simmons 2005).

The specimens examined were collected in tall xerophytic brush with an abundance of prickly pear (*Opuntia* sp.), maguey (*Agave* sp.), and mesquite (*Prosopis* sp.), with isolated individuals of *Juniperus*. These semi-arid places are common habitats for *M. ciliolabrum* (Holloway and Barclay 2001).

An exhaustive review of the specimens deposited in scientific collections is highly desirable, especially those identified as *M. californicus* with which *M. ciliolabrum* is frequently confused. With such a review, misidentified specimens might be "rediscovered" and, thus, improve our understanding of the distribution and habitat of *M. ciliolabrum*, which would be beneficial for assessing the conservation status of this species in Mexico and allow for better conservation plans to be developed. Despite its wide geographical distribution in western North America, *M. ciliolabrum* should be considered a rare species in Mexico where relatively few occurrence data are known.

ACKNOWLEDGEMENTS

We thank A. Pozos-López and D. López for taking pictures and preparing figures and tables, and F. A. Anwarali Khan and two anonymous reviewers for comments on the manuscript. The authors would like to especially thank R. Forsyth for comments and correction of the English version.

ADDITIONAL INFORMATION

Conflict of interest
The authors declare that no competing interests exist.

Ethical statement
No ethical statement is reported.

Funding
This research received no specific funding.

Author contributions
Conceptualization: NGR, JRP, DFGM. Formal analysis: EN, NGR, JRP, ASM, ACC, DFGM. Funding acquisition: NGR, JRP. Writing – original draft: EN, NGR, JRP, ASM, ACC, DFGM. Writing – review and editing: NGR, JRP, DFGM.

Author ORCIDs
Noé González-Ruiz https://orcid.org/0000-0002-4689-333X
José Ramírez-Pulido https://orcid.org/0000-0001-7618-9899
Diego F. García-Mendoza https://orcid.org/0000-0001-9898-683X
Arturo Salame-Méndez https://orcid.org/0000-0002-3255-488X ,
Alondra Castro-Campillo https://orcid.org/0000-0003-2794-4063

Data availability
All data that support the findings of this study are available in the main text.

REFERENCES

Almazán-Catalán JA, Taboada-Salgado A, Sánchez-Hernández C, Romero-Almaraz ML, Jiménez-Salmerón YQ, Guerrero Ibarra E (2009) Registros de murciélagos para el estado de Guerrero, México. Acta Zoológica Mexicana (Nueva Serie) 25: 177–185.

Álvarez-Castañeda ST (1996) Los mamíferos del estado de Morelos. Centro de Investigaciones Biológicas del Noroeste, Baja California Sur, México 211 pp.

Alvarez-Castañeda ST, Álvarez T, González-Ruiz N (2017) Keys for identifying Mexican mammals. Johns Hopkins University Press, Baltimore, USA, 523 pp.

Ammerman LK, Lee DN, Pfau RS (2016) Patterns of genetic divergence among *Myotis californicus*, *M. ciliolabrum*, and *M. leibii* based on amplified fragment length polymorphism. Acta Chiropterologica 18: 336–346. https://doi.org/10.3161/15081109acc2016.18.2.003

Audubon JJ, Bachman J (1842) Descriptions of new species of quadrupeds inhabiting North America. Journal of the Academy of Natural Sciences of Philadelphia 8: 280–323.

Bogan MA (1974) Identification of *Myotis californicus* and *M. leibii* in southwestern North America. Proceedings of the Biological Society of Washington 87: 49–56.

Chávez C, Ceballos G (1998) Diversidad y estado de conservación de los mamíferos del Estado de México. Revista Mexicana de Mastozoología 3: 113–134.

Chávez C, Ceballos G, List R, Salazar I, Espinoza Ávila LA (2009) Mammals. In: Ceballos G, List R, Garduño G, López Cano R, Muñozcano Quintanar MJ, Collado E, San Román JE (Eds.) La diversidad biológica del Estado de México. Estudio de estado Biblioteca Mexiquense del Bicentenario. Colección Mayor. Estado de México, Mexico, 145–152.

Constantine DG (1998) An overlooked external character to differentiate *Myotis californicus* and *Myotis ciliolabrum* (Vespertilionidae). Journal of Mammalogy 79: 624–630.

Davis WB, Russell RJ (1952) Bats of the Mexican State of Morelos. Journal of Mammalogy 33: 234–239.

Davis WB, Russell RJ (1954) Mammals of the Mexican state of Morelos. Journal of Mammalogy 35: 63–80.

Glass BP, Baker RJ (1965) *Vespertilio subulatus* Say, 1823: proposed suppression under the plenary powers (Mammalia, Chiroptera). Bulletin of Zoological Nomenclature 22: 204–205.

Gannon, WL, Sherwin RE, Decarvalho TN, O'Farrell MJ (2001) Pinnae and echolocation call differences between *Myotis californicus* and *M. ciliolabrum* (Chiroptera: Vespertilionidae). Acta Chiropterologica 3: 77–91.

Godínez Álvarez H (2005) *Myotis ciliolabrum* Merriam, 1886. In Ceballos G, Oliva G (Eds.) Los mamíferos silvestres de México. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad y Fondo de Cultura Económica, Sección de Obras de Ciencia y Tecnología, México, Mexico, 282–283.

González-Ruiz N, Navarro-Frías J, Álvarez T, Álvarez-Castañeda ST (2004). Los murciélagos del Estado de México en la Colección de Mamíferos de la Escuela Nacional de Ciencias Biológicas, IPN. In: Castro Campillo A, Ortega J (Eds.) Homenaje a la trayectoria mastozoológica de José Ramírez Pulido. Universidad Autónoma Metropolitana, Unidad Iztapalapa, Mexico City, Mexico, 53–82.

Hall ER (1981) The mammals of North America, volume I. John Wiley and Sons, New York, USA, xv, 600+90 pp.

Hall ER, Kelson KR (1959) The mammals of North America. Volume I. Ronald Press, New York, USA, 546 pp.

Herrera AL (1890) Notes on vertebrates in the Valley of Mexico. Nature (2nd Series) 1: 299–342.

Holloway G, Barclay RMR (2001) *Myotis ciliolabrum*. Mammalian Species 670: 1–5. https://doi.org/10.2307/0.670.1

Kaup, JJ (1829) Skizzirte Entwickelungs-Geschichte und natürliches System der Europäischen Thierwelt. Erster theil welcher die vogel säugethiere und vogel, nebst andeutung der ensttehugng der letzeren aus amphibian enthalt. Darmstadt & Leipzig: C.W. Leske, xii + 204 pp.

López-Wilchis R, López-Ortega G, Owen RD (1994) Noteworthy record of the Western Small-Footed *Myotis* (Mammalia: Chiroptera: *Myotis ciliolabrum*). Southwestern Naturalist 39: 211–213.

Lukens PW, Davis WB (1957) Bats of the Mexican state of Guerrero. Journal of Mammalogy 38: 1–14.

Merriam CH (1886) Description of a new species of bat from the western United States (*Vespertilio ciliolabrum* sp. nov.). Proceedings of the Biological Society of Washington 4: 1–4.

Merriam CH (1890) Part III. Annotated list of mammals of the San Francisco Mountain Plateau and desert of the little Colorado in Arizona, with notes on their vertical distribution, and descriptions of new species. North American Fauna 3: 43–86.

Miller GS Jr, Allen GM (1928) The American bats of the genera *Myotis* and *Pizonyx*. Bulletin of the United States National Museum 144: i–viii, 1–218. https://doi.org/10.5479/si.03629236.144.i

Monterrubio-Rico TC, Charre Medellín JF, Colín-Sot CZ, León Paniagua L (2014) Los mamíferos del estado de Michoacán. Revista Mexicana de Mastozoología (Nueva Época) 4: 1–17.

Núñez Garduño A (2005) Los mamíferos silvestres de Michoacán. Diversidad, Biología e Importancia. Universidad Michoacana de San Nicolás de Hidalgo, Secretaría de Difusión Cultural y Extensión Universitaria, Morelia, Michoacán, 448 pp.

O'Shea TJ, Cryan PM, Bogan MA (2018) United States bat species of concern: a synthesis. Proceedings of the California Academy of Sciences (4th Series) 65 (Supplement 1): 1–279.

O'Farrell MJ, Miller BW, Gannon WL (1999) Qualitative identification of free-flying bats using the Anabat detector. Journal of Mammalogy 80:11–23. https://doi.org/10.2307/1383203

Platt RN, Faircloth BC, Sullivan KA, Kieran TJ, Glenn TC, Vandewege MW, Ray DA (2018) Conflicting evolutionary histories of the mitochondrial and nuclear genomes in New World *Myotis* bats. Systematic Biology 67:236–249. https://doi.org/10.1093/sysbio/syx070

Polaco OJ, Arroyo-Cabrales J, Jones JK Jr (1992) Noteworthy records of some bats from Mexico. Texas Journal of Science 44: 331–338.

Ramírez-Pulido J, Britton MC, Perdomo A, Castro-Campillo A (1986) Guía de los mamíferos de México. Referencias hasta 1983. Universidad Autónoma Metropolitana, Unidad Iztapalapa. Mexico City, México, 720 pp.

Ramírez-Pulido J, Castro-Campillo A (1990) Bibliografía reciente de los mamíferos de México 1983–1988. Universidad Autónoma Metropolitana, Unidad Iztapalapa. Mexico City, México, 120 pp.

Ramírez-Pulido J, Castro-Campillo A (1994) Bibliografía reciente de los mamíferos de México 1989-1993. Universidad Autónoma Metropolitana Unidad Iztapalapa. Mexico City, México, 216 pp.

Ramírez-Pulido J, Castro-Campillo A, Aguilera U (1995) Sinopsis de los mamíferos del Estado de México. Revista de la Sociedad Mexicana de Historia Natural 46: 205–246.

Ramírez-Pulido J, Castro-Campillo A, Aguilera U (1997) Mamíferos. In: Aguilera X, Casas G, Gurrola MA, Ramírez-Pulido J. Castro-Campillo A, Aguilera U, Monrroy O, Pineda E, Chávez N (Eds.) Lista taxonómica de los vertebrados terrestres del Estado de México. Universidad Autónoma del Estado de México, Colección Ciencias y Técnicas, Toluca, Estado de Mexico, Mexico, 159–201.

Ramírez-Pulido J, Castro-Campillo A, Armella MA, Salame-Méndez A (2000) Lista y bibliografía reciente de los mamíferos de México 1994–2000. Universidad Autónoma Metropolitana Unidad Iztapalapa y Consejo Nacional de Ciencia y Tecnología. Mexico City, México, 280 pp.

Ramírez-Pulido J, González-Ruiz N, Ameneyro G, Castro-Campillo A, Salame-Méndez A (2017) Bibliografía reciente de los mamíferos de México: 2000–2010. Universidad Autónoma Metropolitana, Unidad Iztapalapa. Mexico City, México, 417 pp.

Ramírez-Pulido J, González-Ruiz N, Gardner AL, Arroyo-Cabrales J (2014) List of Recent land mammals of Mexico, 2014. Special Publications, Museum of Texas Tech University 63: 1–69. https://doi.org/10.5962/bhl.title.142891

Rodríguez RM, Ammerman LK (2004) Mitochondrial DNA divergence does not reflect morphological difference between *Myotis californicus* and *Myotis ciliolabrum*. Journal of Mammalogy 85: 842–851. https://doi.org/10.1644/1545-1542(2004)085<0842:mdddnr>2.0.co;2

Stadelmann B, Lin LK, Kunz TH, Ruedi M (2007) Molecular phylogeny of New World *Myotis* (Chiroptera, Vespertilionidae) inferred from mitochondrial and nuclear DNA genes. Molecular Phylogenetics and Evolution 43:32–48. https://doi.org/10.1016/j.ympev.2006.06.019

Simmons NB (2005) Order Chiroptera. In: Wilson DE, Reeder DAM (Eds.) Mammal species of the world. A taxonomic and geographic reference, third edition. The Johns Hopkins University Press, Baltimore, USA, 312–529.

Simpson MR (1993) *Myotis californicus*. Mammalian Species 428: 1–4. https://doi.org/10.2307/3504100

Van Zyll de Jong CG (1984) Taxonomic relationships of Nearctic small-footed bats of the *Myotis leibii* group (Chiroptera: Vespertilionidae). Canadian Journal of Zoology 62: 2519–2526. https://doi.org/10.1139/z84-369

Verts BJ, Carraway LN (1998) Land mammals of Oregon. University of California, Berkeley, USA, 668 pp.

Villa-Ramírez B (1953) Mamíferos silvestres del Valle de México. Anales del Instituto de Biología, Universidad Nacional Autónoma de México 23: 269–492.

Villalpando JA, Álvarez T (2000) Murciélagos (Chiroptera) de Michoacán en la colección de mamíferos de la Escuela Nacional de Ciencias Biológicas del IPN, México. Anales de la Escuela Nacional de Ciencias Biológicas 46: 119–165.

Wang HG, Owen RD, Sánchez-Hernández C, Romero-Almaraz ML (2003) Ecological characterization of bat species distributions in Michoacán, México, using a geographic information system. Global Ecology and Biogeography 12: 65–85 https://doi.org/10.1046/j.1466-822x.2003.
00318.x

Watkins LC, Jones JK Jr, Genoways HH (1972) Bats of Jalisco, Mexico. Special Publications, Museum of Texas Tech University 63: 1–44.